

# PROJECT REPORT

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## ➤ INTRODUCTION

### 1. Project Overview

**Enhancing Healthcare Through Intelligent AI Solutions** This project aims to leverage cutting-edge Artificial Intelligence (AI) technologies to address critical challenges within the healthcare sector, improving patient outcomes, optimizing operational efficiencies, and empowering both healthcare professionals and individuals. Our initiative focuses on developing and deploying intelligent AI solutions that can analyse vast and complex medical data, provide actionable insights, and automate routine tasks, thereby transforming traditional healthcare practices.

The scope of this project encompasses the development of AI models for various applications, including:

- **Diagnostic Assistance:** AI-powered tools to aid clinicians in the early and accurate detection of diseases, particularly rare or complex conditions, by analysing medical images, patient histories, and genetic data.
- **Personalized Medicine:** AI systems designed to provide tailored health recommendations, treatment plans, and preventive strategies based on individual patient data, including genomics, lifestyle, and real-time physiological metrics.
- **Operational Optimization:** AI solutions to enhance hospital management, resource allocation, patient flow, and supply chain logistics, leading to reduced wait times, improved staff utilization, and cost efficiencies.
- **Predictive Analytics:** AI models to forecast disease outbreaks, patient readmission risks, and demand for healthcare services, enabling proactive interventions and better preparedness.
- **Administrative Efficiency:** Automation of repetitive administrative tasks to free up healthcare professionals' time, allowing them to focus more on direct patient care.

This project will involve a multi-disciplinary team comprising AI engineers, data scientists, medical professionals, and ethics specialists to ensure the development of robust, reliable, and ethically sound AI solutions that seamlessly integrate into existing healthcare workflows.

### 2. Purpose of Introducing the Health AI Project

The primary purpose of introducing this health AI project is to usher in a new era of healthcare that is more precise, personalized, efficient, and accessible.

By harnessing the power of AI, we aim to:

- **Improve Diagnostic Accuracy and Speed:** To overcome the limitations of human capacity in processing vast medical knowledge and complex data, leading to earlier and more accurate diagnoses, especially for challenging cases. This directly addresses the "difficulty for doctors to keep up with vast medical literature" problem.
- **Enable Truly Personalized Healthcare:** To move beyond generic medical advice towards highly customized health interventions. By analysing individual-specific data, AI will empower patients with actionable insights tailored to their unique biological and lifestyle profiles, thereby addressing the "generic health information not tailored to me" problem.
- **Optimize Healthcare Resource Management:** To create more resilient and efficient healthcare systems capable of dynamic adaptation. AI will provide predictive capabilities for resource allocation, staffing, and patient flow, directly tackling the "challenging and inaccurate prediction of patient influx" problem for hospital administrators.
- **Reduce Healthcare Costs and Enhance Affordability:** By improving operational efficiencies, reducing diagnostic errors, preventing unnecessary procedures, and streamlining administrative tasks, AI can significantly contribute to lowering the overall cost of healthcare delivery.
- **Empower Healthcare Professionals:** To augment the capabilities of doctors, nurses, and administrators by providing intelligent tools that automate routine tasks, synthesize information, and offer decision support, allowing them to dedicate more time to critical thinking and patient interaction.

- **Enhance Patient Experience and Outcomes:** Ultimately, the purpose is to deliver better health outcomes for patients through more timely diagnoses, personalized treatments, and an overall more efficient and responsive healthcare system, leading to reduced stress and increased trust.

In essence, this project is not just about technology; it's about leveraging intelligence to build a healthier future for individuals and a more sustainable and effective healthcare system for all.

## ➤ IDEATION PHASE

### 1. Define the Problem Statements:

#### Customer Problem Statement:

Creating a problem statement to understand your customer's point of view. The Customer Problem Statement helps us focus on what matters to create experiences people will like. A well-articulated customer problem statement allows us to find the ideal solution for the challenges the customers face. Throughout the process, we will also be able to empathize with customers, which helps us better understand how they perceive our product or service.

Problem Statement (PS)	I am (Customer)	I'm trying to	But	Because	Which makes me feel
PS-1	A doctor	Accurately diagnose rare diseases	It's difficult to keep up with the vast and rapidly growing medical literature and symptom variations	The sheer volume of new research and complex patient data makes it impossible for a human to process efficiently, leading to potential misdiagnoses or delayed treatment.	Overwhelmed, frustrated, and concerned about patient outcomes
PS-2	A patient	Understand my personal health risks and preventive measures	The health information available is generic and not tailored to my specific genetic profile or lifestyle	Current health advice often relies on broad population data and doesn't leverage my individual health data (e.g., wearables, genetic tests) to provide personalized insights.	Confused, disempowered, and uncertain about how to improve my health effectively
PS-3	A hospital administrator	Optimize hospital resource allocation (e.g., bed availability, staffing) during peak seasons	Predicting patient influx and resource needs is challenging and often inaccurate	Traditional forecasting methods struggle with the dynamic and unpredictable nature of patient admissions and emergencies, leading to inefficiencies and potential shortages.	Stressed, financially strained, and worried about patient care quality

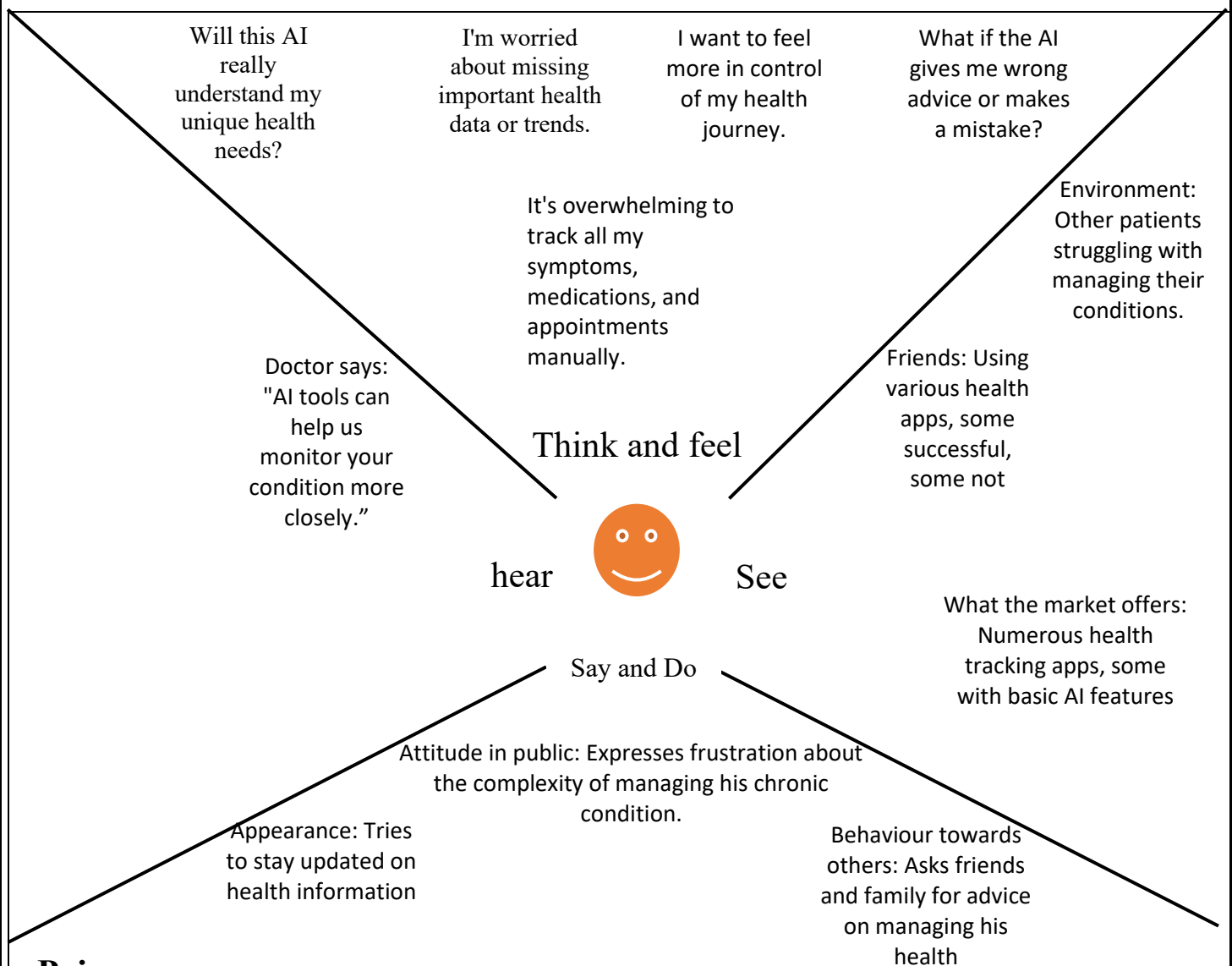
#### Explanation of the examples:

- **PS-1 (Doctor):** Focuses on the challenge doctors face with information overload and the potential for misdiagnosis, where AI could assist with data analysis and pattern recognition.
- **PS-2 (Patient):** Highlights the patient's desire for personalized health insights, where AI could process individual data for tailored recommendations.
- **PS-3 (Hospital Administrator):** Addresses the operational challenges of resource management in hospitals, where AI could offer more accurate predictive analytics.

### 2. Empathize & Discover:

**Empathy Map Canvas:** An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviours and attitudes. It is a useful tool to help us better understand the users. Creating an effective solution

requires understanding the true problem and the person who is experiencing it. The exercise of creating the map helps participants consider things from the user's perspective along with his or her goals and challenges.



## Pain:

- **Fears:** Misdiagnosis due to data oversight; AI making a critical error; privacy breaches of sensitive health data.
- **Frustrations:** Inconsistent health readings; difficulty interpreting complex medical reports; feeling overwhelmed by self-management tasks.
- **Obstacles:** Lack of clear, actionable insights from current health data; difficulty integrating data from various devices; not knowing if he's doing enough to manage his condition.

## Gain:

- **Wants/Needs:** Reliable, personalized health insights; early warning for potential health issues; simplified tracking and management of his condition.
- **Measures of Success:** Improved health markers; feeling more confident in managing his condition; reduced stress about his health.
- **Obstacles (overcome):** Seamless data integration from all health devices; easily understandable summaries of his health status; proactive health recommendations.
- Feeling empowered and supported in his health journey.

## 3. Brainstorming:

- **Brainstorm & Idea Prioritization Template:** Brainstorming provides a free and open environment that encourages everyone within a team to participate in the creative thinking process that leads to problem solving. Prioritizing volume over value, out-of-the-box ideas are welcome and built upon, and all participants are encouraged to collaborate, helping each other develop a rich number of creative solutions.

- Brainstorm link:
- <https://app.mural.co/t/healthai3964/m/healthai3964/1750880673015/b6fc5217be8a3d2dc5cc1680266aa49c395ec59e?sender=u16166b3c9deba44c0b9b8332>

## Brainstorm & idea prioritization

10 minutes to prepare  
1 hour to collaborate  
2-8 people recommended

**Before you collaborate**

To leverage cutting edge Artificial Intelligence (AI) technologies to address critical challenges within the healthcare sector, improving patient outcomes, optimizing operational efficiencies, and empowering both healthcare professionals and individuals

**Team gathering**  
Team lead: geyadul  
Team members: chemakshi  
Team member: hemalatha  
Team member: shreyas  
Team member: shreyas

**Set the goal**  
Enhancing Healthcare Through Intelligent AI Solutions

[Open article](#)

**1 Define your problem statement**

How might we help doctors efficiently process vast medical literature and complex patient data to improve the accurate and timely diagnosis of rare diseases?

**2 Key rules of brainstorming**

Don't judge, Build on others, Stay focused, Stay positive, Don't let others judge you, Go for quantity

**Brainstorm**

Write down any ideas that come to mind. We'll address your problem statement.

**Process 1** AI-powered literature review tool for doctors

**Process 2** Symptom checker AI with differential diagnosis

**Process 3** Genomic data interpretation AI for rare diseases

**Process 4** Virtual AI assistant for diagnostic support

**Need some inspiration?**

Save a handful of concepts or ideas for your next brainstorming session.

[Open example](#)

**3 Prioritize**

Your ideas should all be on the same page about what's important. Now, it's time to prioritize. Please place your ideas on this grid to determine which ideas are important and which are feasible.

**4 After you collaborate**

You can export the ideas as all, 'Import as PDF' to share with members of your company who might find it useful.

**Quick add-ons**

**Share the mood**  
Share a video link to the mood with colleagues to help them better understand the nature of the mood.

**Export the mood**  
Export the mood to a PDF file and share it with colleagues to help them better understand the nature of the mood.

**Keep moving forward**

**Strategy template**  
Define the strategy to help you move forward.

**Customer experience journey map**  
Visualize the customer journey map and identify the key touchpoints.

**Strategic, workstream, opportunity & theme**  
Identify the key strategic, workstream, opportunity & theme.

**Importance**  
How much the idea is important to the business.

**Feasibility**  
How much the idea is feasible to implement.

**AI-powered literature review tool for doctors**

**Genomic data interpretation AI for rare diseases**

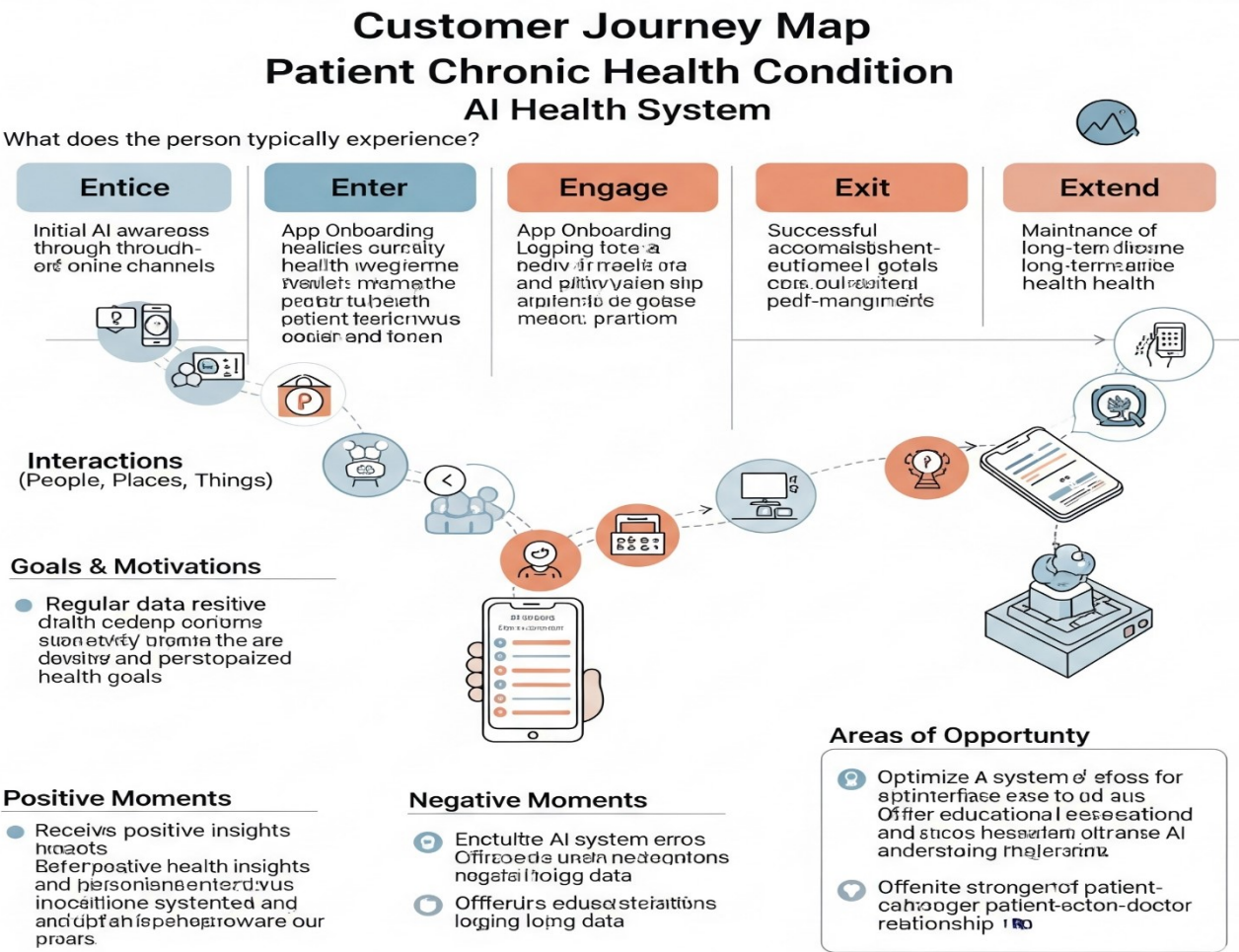
**Symptom checker AI with differential diagnosis**

**Virtual AI assistant for diagnostic support**

## ➤ REQUIREMENT ANALYSIS

### 1. Customer journey map

A Customer Journey Map is a visual representation of a user's experience with a product or service. It's a tool that helps teams better understand their users by capturing their behaviours and attitudes across different stages of interaction.



2. Solution Requirements (Functional & Non-functional)

Functional Requirements:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration & Profile Management	Registration through Form Registration through Secure Health ID (e.g., linked to EHR) Registration through Gmail/LinkedIn (if applicable for non-PHI access) User Profile Creation (medical history, specializations for doctors)
FR-2	User Authentication & Authorization	Confirmation via Email Confirmation via OTP (SMS/Authenticator App) Role-based access control (Doctor, Admin, Researcher)
FR-3	AI-Powered Medical Literature Analysis	Search and Filter Medical Journals/Articles Summarize Key Findings from Research Papers Identify Connections between Symptoms and Rare Diseases from Literature Alert Users to New, Relevant Research Updates

<b>FR-4</b>	<b>AI-Assisted Differential Diagnosis</b>	Input Patient Symptoms & Medical History Suggest Potential Rare Disease Diagnoses (prioritized) Provide Justification for AI Suggestions (evidence-based) Allow Doctor to Refine Symptoms for Re-evaluation
<b>FR-5</b>	<b>Genomic Data Interpretation</b>	Upload Patient Genomic Data (securely) Identify Genetic Markers Associated with Rare Diseases Generate Interpretable Reports on Genomic Findings Cross-reference Genomic Data with Phenotype/Symptoms
<b>FR-6</b>	<b>Virtual AI Assistant (Conversational Interface)</b>	Answer Medical Queries (general & specific to patient data) Guide Users through Data Input (symptoms, medication adherence) Provide Explanations for AI Insights in Layman's Terms Schedule Follow-up Reminders (e.g., medication, appointments)
<b>FR-7</b>	<b>Reporting &amp; Analytics</b>	Generate Patient Progress Reports (for doctors & patients) Track Diagnostic Accuracy and Efficiency Metrics Provide System Usage Analytics (for administrators)

#### Non-functional Requirements:

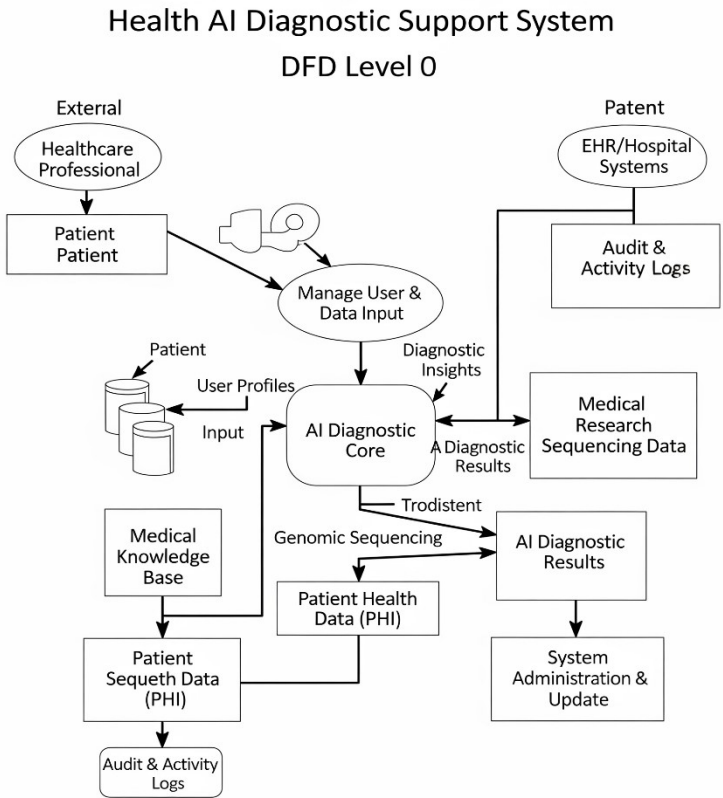
Following are the non-functional requirements of the proposed solution

FR No.	Non-Functional Requirement	Description
NFR-1	<b>Usability</b>	The system shall be intuitive and easy for healthcare professionals and patients to navigate with minimal training. It should have a clean, consistent user interface and provide clear feedback on user actions.
NFR-2	<b>Security</b>	The system shall comply with all relevant healthcare data privacy regulations (e.g., HIPAA, GDPR). It must ensure end-to-end encryption of all patient data (data in transit and at rest), robust access controls, and regular security audits.
NFR-3	<b>Reliability</b>	The AI models shall consistently produce accurate and reliable diagnostic suggestions and interpretations. The system should operate without significant errors or downtime, maintaining data integrity even in the event of system failures.
NFR-4	<b>Performance</b>	The system shall provide timely responses to user queries and AI processing requests (e.g., literature searches, genomic interpretations). Diagnostic suggestions should be generated within acceptable clinical timeframes (e.g., seconds for immediate queries).
NFR-5	<b>Availability</b>	The system shall be available 24/7 with minimal planned downtime for maintenance. Critical diagnostic features should have high availability (e.g., 99.9% uptime).

NFR-6	<b>Scalability</b>	The system shall be able to handle an increasing number of users, patient data, and AI model complexities without significant degradation in performance. It should support future expansion of features and integration with new data sources.
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#### 4. Data Flow Diagram & User Stories

Data Flow Diagrams: A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.



#### User Stories

Use the below template to list all the user stories for the product

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance Criteria	Priority	Release
Healthcare Professional	User Registration & Profile Management	USN-1	As a doctor, I can register for the application using my professional credentials.	I receive a confirmation email and can log in to my professional dashboard.	High	Sprint-1
Healthcare Professional	AI-Powered Medical Literature Analysis	USN-2	As a doctor, I can search the latest medical literature for rare disease information.	I can find relevant articles and summaries related to specific rare diseases or symptoms.	High	Sprint-1



<b>Healthcare Professional</b>	<b>AI-Powered Medical Literature Analysis</b>	USN-3	As a doctor, I want to receive alerts about new, highly relevant research on rare diseases.	I get notifications for new papers matching my areas of interest.	Medium	Sprint-2
<b>Healthcare Professional</b>	<b>AI-Assisted Differential Diagnosis</b>	USN-4	As a doctor, I can input a patient's symptoms and receive AI-generated differential diagnoses.	The AI provides a ranked list of potential rare diseases with supporting evidence.	High	Sprint-2
<b>Healthcare Professional</b>	<b>AI-Assisted Differential Diagnosis</b>	USN-5	As a doctor, I need to see the justification for the AI's diagnostic suggestions	The system provides clear references to medical literature or data patterns supporting each suggestion.	High	Sprint-2
<b>Healthcare Professional</b>	<b>Genomic Data Interpretation</b>	USN-6	As a geneticist, I can upload patient genomic data for AI analysis.	The system securely ingests the genomic file and processes it for interpretation.	High	Sprint-3
<b>Healthcare Professional</b>	<b>Genomic Data Interpretation</b>	USN-7	As a geneticist, I want the AI to highlight genetic markers associated with rare diseases	The AI report clearly identifies and explains relevant genetic variants.	High	Sprint-3
<b>Patient</b>	<b>Virtual AI Assistant</b>	USN-8	As a patient, I can ask the AI assistant questions about my symptoms in simple language.	The AI assistant provides clear, understandable information or prompts me for more details.	Medium	Sprint-2
<b>Patient</b>	<b>Data Management &amp; Integration</b>	USN-9	As a patient, I can manually log my daily symptoms and vitals.	My entered data is stored and reflected in my personal health dashboard.	Medium	Sprint-1
<b>Administrator</b>	<b>Administer System Data</b>	USN-10	As an administrator, I can monitor the overall system performance and user activity.	I can access dashboards showing system uptime, API response times, and active user sessions.	High	Sprint-1
<b>Administrator</b>	<b>Administer System Data</b>	USN-11	As an administrator, I need to manage user accounts and access permissions.	I can add, modify, or deactivate user accounts and assign roles (e.g., Doctor, Researcher).	High	Sprint-1

#### 5. **Technical Architecture:**

The Deliverable shall include the architectural diagram as below and the information as per the table1 & table 2

1.	Application Logic-1	Logic for a process in the application	Java / Python
2.	Application Logic-2	Logic for a process in the application	IBM Watson STT service
3.	Application Logic-3	Logic for a process in the application	IBM Watson Assistant
4.	Database	Data Type, Configurations etc.	MySQL, NoSQL, etc.
5.	Cloud Database	Database Service on Cloud	IBM DB2, IBM Cloudant etc.
6.	File Storage	File storage requirements	IBM Block Storage or Other Storage Service or Local Filesystem
7.	External API-1	Purpose of External API used in the application	IBM Weather API, etc.
8.	External API-2	Purpose of External API used in the application	Aadhar API, etc.
9.	Machine Learning Model	Purpose of Machine Learning Model	Object Recognition Model, etc.
10.	Infrastructure (Server / Cloud)	Application Deployment on Local System / Cloud Local Server Configuration: Cloud Server Configuration :	Local, Cloud Foundry, Kubernetes, etc.

**Table-2: Application Characteristics:**

S.No	Characteristics	Description	Technology
5.	Performance	Design consideration for the performance of the application (number of requests per sec, use of Cache, use of CDN's) etc.	Technology used

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	List the open-source frameworks used	Technology of Opensource framework
2.	Security Implementations	List all the security / access controls implemented, use of firewalls etc.	e.g. SHA-256, Encryptions, IAM Controls, OWASP etc.
3.	Scalable Architecture	Justify the scalability of architecture (3 – tier, Micro-services)	Technology used
4.	Availability	Justify the availability of application (e.g. use of load balancers, distributed servers etc.)	Technology used

➤ **FUNCTIONAL AND PERFORMANCE TESTING**

**The code is based on the html file which will be executed in the browser output box this code has both front end and back end in one program**

```

<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8" />
  <meta name="viewport" content="width=device-width, initial-scale=1.0"/>
  <title>Health AI Chatbot</title>
  <style>
    body {
      font-family: Arial, sans-serif;
      background-color: #f0f8ff;
      margin: 0;
      padding: 0;
    }
    .chat-container {
      max-width: 600px;
      margin: 40px auto;
      background: white;
      border-radius: 10px;
      box-shadow: 0 4px 10px rgba(0,0,0,0.1);
      overflow: hidden;
    }
    .chat-header {
      background: #007acc;
      color: white;
      text-align: center;
      padding: 20px;
      font-size: 1.5em;
    }
    .chat-box {
      height: 400px;
      overflow-y: auto;
      padding: 20px;
      border-bottom: 1px solid #ddd;
    }
    .chat-message {

```

```

    margin: 10px 0;
  }
  .chat-message.user {
    text-align: right;
    color: #333;
  }
  .chat-message.bot {
    text-align: left;
    color: #007acc;
  }
  .chat-input {
    display: flex;
    border-top: 1px solid #ccc;
  }
  .chat-input input {
    flex: 1;
    padding: 15px;
    border: none;
    font-size: 1em;
  }
  .chat-input button {
    padding: 15px;
    background: #007acc;
    color: white;
    border: none;
    cursor: pointer;
  }
  .chat-input button:hover {
    background: #005f99;
  }
</style>
</head>
<body>

<div class="chat-container">
  <div class="chat-header">Health AI Chatbot</div>
  <div class="chat-box" id="chatBox"></div>
  <div class="chat-input">
    <input type="text" id="userInput" placeholder="Type your health question..." />
    <button onclick="sendMessage()">Send</button>
  </div>
</div>

<script>
function sendMessage() {
  const input = document.getElementById('userInput');
  const chatBox = document.getElementById('chatBox');
  const userText = input.value.trim();
  if (!userText) return;

  // Add user message
  chatBox.innerHTML += `<div class="chat-message user"><strong>You:</strong>
${userText}</div>`;

```

```
// Bot response
const botText = getBotReply(userText);
chatBox.innerHTML += `<div class="chat-message bot"><strong>Bot:</strong> ${botText}</div>`;

input.value = "";
chatBox.scrollTop = chatBox.scrollHeight;
}

function getBotReply(input) {
  const msg = input.toLowerCase();
  if (msg.includes("fever")) {
    return "You may have an infection. Rest, stay hydrated, and monitor your temperature.";
  } else if (msg.includes("headache")) {
    return "Try to rest, reduce screen time, and drink water. See a doctor if it persists.";
  } else if (msg.includes("cold")) {
    return "Rest, stay warm, and drink fluids. If symptoms worsen, consult a doctor.";
  } else if (msg.includes("covid")) {
    return "Isolate, monitor your symptoms, and get tested. Contact health services if needed.";
  } else if (msg.includes("stomach")) {
    return "Eat light foods, stay hydrated, and avoid spicy meals. Consult a doctor if pain continues.";
  } else {
    return "I'm here to help with health questions. Can you provide more details?";
  }
}
</script>

</body>
</html>
```

## ➤ **RESULTS**

### **5.1 Output**

#### **Screenshots**

